

NOAA Deep-Sea Coral and Sponge Ecosystems Exploration and Research Priorities Workshop for the Northeast U.S.

James J. Howard Marine Science Laboratory, Highlands, NJ
August 9-10, 2011

Introduction

On August 9 – 10, 2011, scientists and resource managers met at the James J Howard Marine Science Laboratory, in Highlands, NJ to further define the exploration and research priorities laid out in the *NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems*, and to identify critical information needs for deep-sea coral and sponge ecosystems off the Northeast U.S. coast. The workshop was funded by NOAA's Deep-Sea Coral Research and Technology Program.

The ultimate goal of the workshop was to identify steps necessary to improve the understanding needed to conserve and manage these deep-sea ecosystems. Workshop participants represented a broad range of stakeholders including the Federal government, the New England and the Mid-Atlantic Fishery Management Councils, academia, private industry, nongovernmental organizations and Canadian academic and governmental representatives (See Appendix A for a list of participants).

The NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems

The NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems identifies national-level goals, objectives, and approaches to guide NOAA's research, management, and international cooperation activities on deep-sea coral and sponge ecosystems for 2010 through 2019. The primary goal of the Strategic Plan is to improve the understanding, conservation, and management of deep-sea coral and sponge ecosystems. The Strategic Plan covers deep-sea coral and sponge ecosystems under the jurisdiction of the United States and international cooperation activities undertaken by the United States.

The Strategic Plan is divided into three sections: (I) Exploration and Research, (II) Conservation and Management, and (III) International Cooperation.

Section I identifies the role of research in management, including NOAA's priorities and objectives for research and exploration of deep-sea coral ecosystems and anticipated products for each objective. The goal of NOAA's exploration and research on deep-sea coral and sponge ecosystems is to provide decision-makers with sound scientific information that will enable effective ecosystem-based management decisions.

Section II lays out objectives and approaches that NOAA will undertake to enhance protection of deep-sea coral and sponge ecosystems working with the Regional Fishery Management Councils, National Marine Sanctuaries (ONMS), and other Federal agencies and partners.

NOAA's strategy for managing deep-sea coral and sponge ecosystems is centered on the authority provided to NOAA through the Magnuson-Stevens Fishery Conservation and Management Act and the National Marine Sanctuaries Act.

Section III describes NOAA's participation in international activities to protect and/or conserve deep-sea coral and sponge ecosystems.

The Strategic Plan provides guidance for all NOAA programs supporting research, management, and international cooperation activities on deep-sea coral and sponge ecosystems. Within NOAA, these activities are coordinated among four NOAA line offices – the National Ocean Service (NOS); National Marine Fisheries Service (NMFS); National Environmental, Satellite, and Data Information Service (NESDIS); and Office of Oceanic and Atmospheric Research (OAR). NOAA will implement the national Strategic Plan by further refining the objectives and approaches stated therein to address issues at the regional level. This workshop focuses on discussing Section I of the Strategic Plan (Exploration and Research) to identify critical information needs for the U.S. Northeast region, which encompasses waters under U.S. jurisdiction from the Canadian border to Cape Hatteras, North Carolina. It will help guide the three-year regional research initiative under the Deep-Sea Coral Research and Technology Program.

About the Workshop

Workshop Goal:

- To develop a list of critical information needs and a proposed plan of action to guide NOAA's three-year research program that will address both science and management needs related to deep-sea coral and sponge resources in the US Northwest Atlantic.

Workshop Objectives:

- Review and understand existing exploration and research objectives for deep-sea coral and sponge ecosystems in the US Northwest Atlantic.
- Identify critical regional exploration and research information needs.
- Develop descriptions of priority activities that will address those needs.

The workshop was hosted by the James J. Howard Marine Science Laboratory, the NOAA Fisheries Lab, based in Gateway National Park, Sandy Hook, Highlands, NJ. A steering committee, consisting of representatives from NOAA (NMFS, ONMS, NERO, OER and DSCR&TP) as well as the two regional Fishery Management Councils (NEFMC and MAFMC), were responsible for the workshop planning and organization. **The workshop, itself, was a two day event that included a series of six presentations, to update and engage the participants, followed by breakout sessions and group discussions.** (see Appendix B for workshop agenda)

Workshop Results

Day 1: Presentations and Breakout Group Discussions

To set the stage and provide perspective for the workshop goals and outcome, a series of four US and two Canadian presentations were given that highlighted NOAA's deep-sea coral program and work being done by our Canadian colleagues . A summary of those talks is given below:

Presentations: National, Regional and International Plans, Status and On-Going Research:

- 1) The initial presentation gave an overview of NOAA's Strategic Plan for Deep-Sea Coral and Sponge Ecosystems, beginning with a statement of NOAA's goal, which is to: **Improve the understanding, conservation, and management of deep-sea coral and sponge ecosystems**, which is to be achieved through: 1) Exploration and Research, 2) Conservation and Management and 3) International Cooperation. The primary authority under which the mission will be accomplished is the Magnuson-Stevens Fisheries Conservation and Management Act of 2006. This legislation established the Deep-Sea Coral Research and Technology Program (Sec. 408) and created new discretionary authority to protect deep-sea coral areas identified by the Program from damage by fishing gear (Sec. 303(b)(2).

The Deep-Sea Coral Research and Technology Program, in turn, aims to provide sound scientific information needed to conserve and manage deep-sea coral ecosystems. In accordance with the Magnuson-Stevens Act, its ongoing efforts include:

- Identify existing research on, and known locations of, deep-sea corals
 - Develop GIS databases to manage deep-sea coral information
 - Analyze existing information
 - Monitor activity in deep-sea coral locations
 - Analyze distribution and intensity of fishing using bottom-contact gear
 - Develop methods to enhance information from bycatch
 - Conduct research to locate and map deep-sea corals
 - Major regional field research initiatives are in various stages of completion: the southeast (2009-2011) is nearly complete, work is ongoing off the west coast (2010-12) and Alaska (2012-14), and the program is coming to the Northeast in 2013.
- 2) A regional update on coral and sponge ecosystems followed this national overview and updated the status report that was published by NOAA in 2007. Briefly, since that publication, research has focused primarily on data mining with some field work, with the field work limited primarily to the region's seamounts. The data mining has significantly increased the numbers of records for stony corals, alcyonaceans, and sea pens. Other research has documented species associations and evaluated the genetic

connectivity between corals on the seamounts. While work inshore, in relatively shallow areas off the coasts of Maryland and Delaware, has documented hard-bottomed patch reefs with the occurrence of soft corals. Finally, a fairly extensive multibeam mapping effort has been focused in Hudson Canyon, off New York, resulting in the identification of potential deep-sea coral habitats.

- 3) The National Marine Sanctuaries Program presentation highlighted the current and ongoing efforts of ONMS and their partners working toward the possible establishment of national marine sanctuaries that focus on the conservation and protection of submarine canyon and seamount environments off the northeast and mid-Atlantic coasts. However, the likelihood of creating new sanctuaries is uncertain as, by federal regulation, new sites designated by the Administration must come off of a list of potential national marine sanctuary candidate sites. NOAA is in the process of reviewing this sanctuary Site Evaluation List (SEL) which is currently inactive.
- 4) The two regional Fishery Management Councils combined forces to update the workshop participants on their efforts to conserve and manage fisheries and fish habitat in the US EEZ in accordance with Sections 305(b) Essential Fish Habitat; and 301(a)(9); and 303(b) (discretionary provisions) of the Magnuson Act. Previous actions that provide protections for corals and associated habitats were undertaken via the EFH authority. Management actions being developed as part of NEFMC's EFH Omnibus Amendment will rely on the discretionary authority. Currently there are several options being considered for coral management: the discrete area framework and the broad area framework. Under the discrete coral framework, specific locations, including specific canyons, seamounts and/or coral zones in the Gulf of Maine would be closed to mobile bottom tending gear and/or bottom tending gear under certain circumstances or for certain fisheries. Under the broad area framework, a large area seaward of some depth along the shelf slope would be closed to mobile bottom tending gear and/or bottom tending gear, again with access provisions under certain circumstances or for certain fisheries.
- 5) With the US/Canadian border dividing the Gulf of Maine, two presentations focused on coral related activities by Canadian academics and the Department of Fisheries and Oceans. Our Canadian colleagues have a multifaceted program of research related to deep-sea corals and sponges, which includes habitat mapping, basic biology, i.e. abundance, distribution, reproduction, recruitment and growth studies, as well as assessing species associations and the role of corals in the structure and function of microhabitats. In terms of management the Canadian approach to identification of sponge and coral 'hotspots', or high density clusters of these organisms, has enabled the closure of specific areas while maximizing fishing opportunities. Both presenters suggested that a way forward was through international collaboration. This might include sharing ship/remotely operated vehicle time, samples and databases as well as sharing our approaches and methodologies on identification and characterization of

coral habitats and understanding ecological processes that structure and sustain deep-sea corals.

A Plenary Session for a General Discussion followed the Presentations. Some of the major discussion points were:

- Identification of species of corals from a photograph is difficult and identifications are dubious. Unfortunately, photographs, rather than physical coral collections, represent a large percentage of the available data sources. However, first level conservation measures do not necessarily require species specific identification.
- Is it important to identify the connectivity between corals and coral habitats? Much of the existing data are point or absence/presence data, not to mention that some of the older location data is not necessarily accurate by today's standards. There is also the issue of current versus historic presence. Anecdotal information suggests that with intense fishing in the northeast it is likely that the continental shelf has been so heavily trawled, and over such a long period of time, that most structure forming corals have been removed from suitable coral habitats and, although some growth rate data are available, studies of recovery times do not exist.

Breakout Group Day 1:

The participants were divided into three breakout groups and were tasked with addressing critical information needs in the following areas:

- 1) Location and characterization of deep-sea coral and sponge ecosystems
- 2) Biology, biodiversity and ecology of deep-sea corals and sponges
- 3) Natural and human Impacts on deep-sea coral and sponge ecosystems

Following the breakout groups a plenary session was convened where each group summarized their discussion of these topics. The discussion that followed the group summaries resulted in a series of questions that attempted to capture the critical information needs under the three headings above. These questions, and where appropriate their sub-questions, were voted on by each individual workshop participant and the votes tallied. A listing of critical needs, for each topic area, was compiled and is presented below. In the case of the discussions on Location and Characterization, however, the group concluded that this was generally a high priority area of information needs. They developed a list of questions to more specifically guide research but agreed that they would not vote to prioritize this particular list. For the other two topic areas, Biology and Human Impacts, the workshop participants did vote on the questions and the highest priority item is listed first, with the remainder in descending order of priority.

Location and Characterization of Deep-Sea Corals and Sponges

1. What are the parameters necessary to generate and validate predictive models of coral distributions?

2. What data do we need (biological and environmental/physical oceanographic/substrate data) to predict and map coral distributions and abundance at the shelf/slope scale?
 - What is the quality of existing data? Includes data that are in the current coral database and already collected but not integrated into the database.
 - Do we need broad scale multibeam surveys to know the right places to sample?
 - Are there areas that we are missing entirely?
 - What information needs to be extracted from existing databases/survey records/observations?
3. At what scale do we need information on deep-sea corals for management purposes?
4. What information needs to be extracted from existing data/survey records/observations?

Biology, Biodiversity and Ecology of Deep-Sea Corals and Sponges

1. What are the life history limitations that would be most beneficial to know from a management standpoint?
 - How do corals reproduce, grow, disperse, recruit?
 - What are coral growth rates, how long-lived are they?
2. What are the species associations?
 - What role do corals play in the deep-sea ecosystem?
3. What are the associations between deep-sea corals and their habitats (including but not limited to substrate)?
 - What are the oceanographic conditions that define deep-sea coral habitats?
4. How are deep-sea coral communities structured?
 - How do corals integrate into deep-sea food webs?
5. What are the deep-sea coral species? What is the connectivity between deep-sea coral populations, in either an ecological or an evolutionary context, or both?

Natural and Human Impacts on Deep-Sea Coral and Sponge Ecosystems

1. What types of disturbance (natural and anthropogenic) do deep-sea coral communities face?
 - Where do these disturbances currently occur or where are they likely to occur?
 - What is the relative significance of these impacts?
2. What are the economic and social values, including ecosystem service values, associated with deep-sea corals?
3. How resilient are different deep-sea coral communities to various types of disturbance?
 - Is recovery possible and over what time scales?

Meeting was adjourned after a review of the day's progress.

Day 2: Plan of Action

The objective of the second day was to convert research needs/questions into more specific goals and activities that will address NOAA's deep-sea coral and sponge mandate. The prioritized lists of critical information needs above was to be considered in the context of developing action plans that specifically address these needs. Each breakout group was charged with answering the questions; How? Where? When (duration and sequence)? Who (collaborators)? The purpose is to offer the DSCR&T Program more specific guidelines on what the participants representing the interests of northeast deep-sea coral community would like to see accomplished in the next three years. The final session of the day was devoted to identifying potential partners and discussing how our work in the northeast could complement and be complemented by collaborating with State, Federal and academic scientists, the NGO community and, internationally, with our Canadian colleagues.

Breakout Group Day 2 and Plenary Discussion:

The three breakout groups discussed the questions under the three broad heading related to **location, biology and impacts** for deep-sea corals and sponges. The breakout groups reconvened in a plenary session to present the group's results and open the discussion to the overall group. The plenary presentations and discussion are summarized below.

Location and Characterization of Deep-Sea Coral and Sponge Ecosystems

Gap Analysis:

Since much of what is known about location and characterization of deep-sea coral and sponge habitats is based on historical data and catch records, the first step is an evaluation of existing data. This could be done using Gap Analysis, with a geographic focus on canyons and seamounts in the northeast where it is assumed that there is a greater concentration of deep-sea corals. Data should be thoroughly reviewed, digitized and reevaluated in light of the current interest in protecting these deep water resources. A significant amount of data mining has been completed, but there are archived towed camera, ROV, and submersible dive records (e.g., *ALVIN* dives from the 70s, 80s, and 90s at WHOI) that have never been reviewed to extract deep-sea coral data. In addition, the available presence only database mostly includes point locations where corals were observed. It contains very little useful coral abundance or density information and does not include absence data, associated megafauna, or habitat features observed at these locations.

It was recommended that archived records be thoroughly reviewed, digitized and re-evaluated in light of the current interest in protecting these deep water resources, possibly using image-recognition techniques and focusing on dives that are more likely to have encountered deep-sea corals and sponges and storage media (tapes, film, etc.) that are in better condition. A recent data rescue project with the University of Connecticut Undersea Research Center

archives demonstrated that the labor costs were very high relative to the amount of new data obtained.

Another suggestion was to use existing data to select a few locations (e.g., canyons) where deep-sea corals have been observed, identify information gaps, then try to extract missing information from archived records during the first year of the upcoming three-year research effort. Once all existing data sources have been exhausted for the selected sites, direct 2014-2015 survey work to provide the remaining data. Data “rescue” efforts for selected study sites would also serve to improve the quality of predictive models which can be used to identify sites where research efforts should be focused (see below).

Absence data, which are rare, should not be ignored, but absence *per se* does not exclude the possible existence of corals. Coral aggregations can be very difficult to find, even when precise location and multibeam data are available, particularly in the northeast. But absence data can be used to develop more powerful predictive models, as well as to help determine which areas are lower priorities for surveys.

Fishing effort also needs to be accounted for when trying to determine location and distribution of corals. It might be possible to evaluate fishery observer/vessel trip report/vessel monitoring system data to determine where fishing is most concentrated, and therefore where it is least likely that significant numbers of corals will be present due to trawling impacts from fishing.

The above evaluation(s) should be undertaken in the first year of the three year study as it could have a major impact on the success of any field sampling.

Finally, concern was expressed that *if* substantial data gaps are identified management decisions could be delayed until “sufficient” additional information is available. Also, the mode of collection is important to consider in terms of what kind of picture this analysis will present. Corals may have been incidentally observed on a wide variety of surveys, but not recognized for what they actually were, or how unique they might be, and simply labeled as bycatch.

Predictive Modeling:

There are currently some published predictive models, especially from Canadian waters for species such as *Paragorgia arborea* and *Primnoa resaediformis*. These should be reviewed and parallel efforts initiated for US waters. Various model inputs, such as depth, slope, rugosity, temperature, current, surface productivity, etc., should be compiled and incorporated into any predictive model. This information exists, at least at a coarse resolution, throughout the region, and should form the basis for a predictive modeling effort.

It was noted that models alone may be doing more harm than good if results are not accurate. The scales of resolution for input parameters is a possible issue, as well as needing to decide what types of corals to model since “corals” includes a variety of life forms with their own unique, species specific, requirements. One of the questions that can be addressed through modeling is the spatial scale of resolution needed for management versus the clearly defined

benthic and water column habitat requirements needed for specific corals to exist. Are the spatial scales needed for management and modeling the same or different? Are there new areas that have never been sampled that one might want to sample in order to validate a model?

Modeling addresses, at least initially, the large scale and gives an approximation, or probability of finding corals given our understanding of a particular set of environmental parameters. Modeling is also a first order activity for working in the northeast since this will guide field work over a vast geographic area with relatively low coral densities.

Field Work:

Multibeam acoustic surveys have been conducted on a limited scale and continue to be done on ships of opportunity. Hudson, Norfolk, Wilmington, and Baltimore canyons have been/are being surveyed and this effort should be expanded. Key results from these surveys include detailed bathymetric and topography data and, from acoustic backscatter signal data, substrate type; particularly for areas along the outer continental shelf, and on the seamounts, and in certain deep-water locations in the Gulf of Maine. It was recommended that multibeam surveys be conducted in 2013 in all areas of the outer continental shelf and slope that have not yet been surveyed as of the first steps towards selecting target study sites for more intensive field work in 2014-2015. A primary product from the multibeam survey work would be maps showing depths, slopes, and bottom rugosity and roughness. Ground-truthing conducted in selected locations during 2014-2015 would provide the information needed to more accurately identify bottom types, at least in the selected locations.

Site-specific research designed to locate and characterize deep-sea coral and sponge habitats and ecosystems would require the use of a variety of types of equipment, including submersibles, remotely-operated or autonomous underwater vehicles, towed camera systems, etc. Water column properties such as temperature, pH, and currents could be monitored continuously using moored buoys and/or gliders. No specific recommendations were made at the workshop since the selection of equipment and survey methods will depend on the objectives of the site-specific research and funding

Biology, Biodiversity and Ecology of Deep-Sea Corals and Sponges

Species Identification:

There are a number of basic biological questions related to deep-sea corals that remain unanswered. First and foremost, identification of the species based on both morphology and genetics is fundamental knowledge for any other biological work. This will require physical samples and taxonomic as well as genetic scientific expertise. Although some samples already exist in museum collections, more samples will be required. It is also imperative to develop an understanding of species specific characteristics that can be identified in photographs, since photographic images are becoming increasingly important in benthic studies.

The scale of sampling is important to consider not only for taxonomic work but also for potential genomic studies that relate to questions of connectivity over varying spatial scales. It might be a good strategy to initially focus on one area (canyon) in detail, and then expand the sampling regime in multiple locations.

Connectivity:

Expanding up from identification of an individual species to the broader area of coral ecology generates a need for more intensive and frequent sampling. Environmental parameters will need to be monitored over time to evaluate connectivity for both the corals and associated species. This will require deploying such things as sediment traps, time lapse camera systems, photo mosaics of the study site and conducting *in situ* and laboratory experimental work to determine environmental characteristics required for various species, and then determine how such characteristics relate to connectivity between coral populations. This work could also aim to characterize the role of corals as ecosystem engineers, and document trophic interactions.

To understand gene flow within and between patches of corals, and thus genetic connectivity, multiple samples will have to be taken within each coral aggregation. There is already work that has been done in the northeast on seamounts and this work could fill in gaps in knowledge and should be continued and possibly expanded.

What Biological Information is Most Important for Designing a Coral Management System?

Growth rates, age, and connectivity are all important to management since these parameters are reflective of how fast a species can recover following fishing or other perturbation. Understanding the reproductive processes is also key, and relating reproduction to recruitment through an understanding of both the local and larger scale oceanographic conditions is a critical need. The need for this information, and the scale on which it should be collected, is guided by the management and conservation process and their need for information. Because of the paucity of contemporary data, collecting basic biological information should be ongoing both temporally and spatially.

To achieve a better understanding of coral and coral biology samples of corals are required. These coral collections need to be distributed to appropriate experts and funding must be made available for proper data analyze and reporting. Sampling will need to be repeated, to assess seasonal change, and protocols need to be developed to capitalize on coral bycatch in other surveys. For example, observers and technicians need to be taught proper protocols for preserving these samples. Partnerships between academic institutions, government agencies, and NGOs conducting deep-sea coral research need to be fostered and maintained. Research facilities will require support to carry out experimental work. Those facilities that have this capacity or are developing this capacity should be encouraged, potentially financially, to continue research that addresses fundamental data gaps.

Natural and Human Impacts on deep-sea coral and sponge ecosystem

Understanding Disturbance Effects and Recovery

Although there are numerous studies and reviews on the impact of trawling and dredging on the seafloor and the potentially deleterious effects on the sessile benthic community, there is little coral specific information on the interaction between fishing and coral habitats in the northeast US, although there is information available from Alaska, the western Pacific, Canada and Europe. Indeed, virtually all the information from the Northeast region is either anecdotal (e.g., reports of coral colonies coming up in fishing nets) and/or inferential (e.g., photographs of corals in locations where no fishing occurs). There is, however, enough information from other locations to infer, in a general sense, that deep-sea corals and sponges – particularly the larger and more fragile species – are highly susceptible to removal or damage from towed fishing gear and, to a lesser extent, from fixed gear such as bottom longlines, gillnets, and traps. What is needed is more specific information relating to the recovery potential of the more common and vulnerable species found in canyons in the northeast region.

In addition to fishing impacts, areas of the seabed off the northeast coast will be open for petroleum exploration, initially with seismic surveys and then drilling if indications are positive for the presence of gas or oil. The initial focus will be in the southern canyon areas, off Virginia, Delaware, and Maryland. Although not as pressing an issue at this time, and potentially not as destructive as fishing in the canyon heads, exploration for oil and gas is a potential perturbation that should be taken into consideration when anthropogenic impacts in the deep-sea are concerned, starting with documenting and evaluating lease sites.

What are the economic and social values associated with deep-sea corals?

A documentable link between corals and managed species establishes a direct, economically based, ecosystem service provided by corals. In other words, by answering the question, what role do corals play in controlling the abundance, and determining the distribution and survival of commercially valuable species we can quantify a direct economic benefit? Or, to re-state it, can deep-sea coral habitats be considered essential fish habitat? There are other measures, particularly of social value, like “willingness to pay” where a fee for entry into a marine park is charged to protect corals. However, this is, perhaps, more easily estimated for shallow water corals and near shore marine protected areas. The value of deep-sea corals is, to some extent, reflected in their inclusion under the Magnuson-Stevens Fisheries Conservation and Management Act 2006. But, that legislation is more related to determining the ecological values of this resource rather than defining its’ specific economic value. Social scientists and non-governmental agencies should be involved in the deep-sea coral initiative to research and better define the value of these resources and the need/importance for protecting them. It is suggested that these studies be initiated early on in the program so that by the end of the current funding cycle the benefits of deep-sea corals will be documented. One issue that plagues a deep-water resource that is out of sight and out of mind can partially be addressed by simply making people aware of its existence and its role in the ecosystem. Research platforms, like the NOAA ship *Okeanos Explorer*, are capable of bringing deepwater images into the classroom and should be considered as a mechanism to inform the public about these resources.

Identifying Opportunities and Constraints

The final plenary session of the workshop was an open discussion to on opportunities and constraints for the upcoming deep-sea coral funding cycle. It was not intended to identify funding opportunities as much as identify ways that funding and in-kind contributions could be leveraged to enhance the overall research program in the northeast. The following list is not exhaustive but does reflect the known and possible venues for expanding the program.

Opportunities for Collaboration

Federal agencies like the **Bureau of Ocean Energy Management (BOEM)**, in the Department of the Interior, play an important role in evaluating offshore habitats in terms of the impacts of energy development. Through interagency and cooperative agreements they have funded extensive multi-year studies on deep-sea corals. Currently BOEM is funding a mid-Atlantic canyon study, including Washington, Norfolk, and Baltimore canyons. NOAA's Office of Exploration and Research (OER) and the US Geological Survey (USGS) are involved in these studies as well. It should be noted that an Interagency Agreement has been signed between the Department of Commerce, NOAA, and the Department of the Interior, BOEM, which could facilitate energy related, deep-sea, studies that could directly involve assessment of deep-sea coral and sponge resources. With the growing interest in wind energy development and continuing pressure to explore the deeper sea for petroleum resources it is likely that BOEM will be a partner on future deep-sea coral projects.

Regional associations, including the **Mid-Atlantic Regional Ocean Council (MARCO)** and the **Northeast Regional Ocean Council (NROC)** are also potential partners in deep-sea coral research and data management and are currently working with the Deep Sea Coral Research and Technology Program. Both organizations are establishing data portals that could be a venue for presenting results of deep-sea coral research and offering a mechanism for public outreach and information sharing about such deep water resources.

There is a strong possibility of collaborating with our **Canadian colleagues**, both academic and governmental scientists. The Deep Sea Coral Research and Technology Program is currently collaborating and sharing technical resources with the Canadian Department of Fisheries and Oceans in field research off the Pacific Coast. Preliminary discussions suggest that the Canadians may be able to support research on the US side of the border with a deep diving remotely operated vehicle. They have also expressed a willingness to have US scientists involved on some of the deep-sea coral and sponge cruises they are conducting in Canadian waters. Canadian cold, deep water, coral and sponge research includes a diverse group of scientists and it is strongly recommended that efforts be made to reach out to our Canadian colleagues to engage them in US research efforts, both as co-principal investigators as well as partners to share valuable resources such as ship time and equipment to the benefit of both country's research programs.

In the US, the **National Science Foundation (NSF)** should be approached to see if there is a way to leverage the impending NOAA funding against NSF support for academics that are interested

in deep-sea corals and sponges. This would include the possibility of ship time through the **University-National Oceanographic Laboratory System (UNOLS)** fleet use deep-diving equipment like *Alvin* and *Jason*, and the prospect of matching some of this time with NOAA fleet vessels, like the *Okeanus Explorer*.

The **Navy** expends a vast effort to map the seafloor and they should be approached regarding the availability of existing multibeam data or the possibility of opportunistic multibeam surveys in locations likely to support deep-sea corals and sponges.

The **Trans-Atlantic Coral Ecosystem Study (TRACES)** is another potential collaborator in deep-sea coral research, although they would not bring any additional sources of funding.

Constraints on the Process:

The two fishery management councils are currently working on regulations to conserve and protect deep-sea coral and sponge resources. Management alternatives will be approved for inclusion in a draft omnibus essential fish habitat amendment in the spring of 2012, and a complete draft amendment will be available for analysis and public comment sometime in 2013. Results of the research program, beginning in 2013, will therefore be used to update and revise management decisions that are being made now rather than providing information in support of the initial decisions.

The establishment of a three year research program by the Deep-Sea Coral Research and Technology Program is a major step forward, and may serve to leverage additional research support through some of the potential collaborations mentioned above, but it should also be recognized that the challenge of working in the deep-sea will require a much more extensive and long-term commitment to truly understand this ecosystem. It will be imperative that the three research plan be thought through carefully and realistic goals are set; ones that can be achieved within the time allotted and with measurable results and impact on the management process.

Conclusion: Wrap up

The NOAA North Atlantic Deep-Sea Coral and Sponge Workshop brought together a diverse group of stakeholders representing both scientific and management interests to intensely discuss deep water resources and identify and prioritize information needed to successfully manage and protect these resources. The discussions, captured in this report, will serve as a guide to NOAA's Deep-Sea Coral Research and Technology Program as they look forward to funding three years of research activity in the western North Atlantic.

Appendix A: List of Participants

Participant Name	Participant Affiliation	E-Mail address
Greg Boland	Bureau of Ocean Energy Management, Regulation and Enforcement	gregory.boland@boemre.gov
Barbara Hecker	Private Consultant	bhecker@earthlink.net
Dave Packer	NOAA Northeast Fisheries Science Center	Dave.Packer@noaa.gov
Dave Stevenson	NOAA Northeast Regional Office	David.Stevenson@noaa.gov
Ellen Kenchington	Department of Fisheries and Oceans, Canada	Ellen.Kenchington@dfompo.gc.ca
Erik Cordes	Temple University	ecordes@temple.edu
Fan Tsao	NOAA Deep-Sea Coral Research and Technology Program	Fan.Tsao@noaa.gov
John Tomczuk	NOAA Oceanic and Atmospheric Research	John.Tomczuk@noaa.gov
Martha Nizinski	NOAA National Systematics Laboratory	Martha.Nizinski@noaa.gov
Michelle Bachman	New England Fishery Management Council	mbachman@nefmc.org
Rhian Waller	University of Maine	rhian.waller@maine.edu
Paul Ticco	NOAA NE & Glakes Marine Sanctuaries	Paul.Ticco@noaa.gov
Rich Langton	NOAA Northeast Fisheries Science Center	rich.langton@noaa.gov
Brad Sewell	National Resources Defense Council	bsewell@nrdc.org
Scott France	University of Louisiana at Lafayette	france@louisiana.edu
Steve Ross	University of North Carolina Wilmington	rossss@uncw.edu
Anna Metaxas	Dalhousie University	Anna.Metaxas@dal.ca
Tom Hoff	Mid-Atlantic Fishery Management Council	thoff@mafmc.org
Santiago Herrera	Woods Hole Oceanographic Institute	sherrera@whoi.edu

Appendix B: Workshop Agenda

NOAA North Atlantic Deep-Sea Corals and Sponges Workshop

Exploration and Research Priorities

August 9-10, 2011

James J. Howard Marine Science Laboratory, Highlands, NJ

AGENDA

Goal:

- To develop a list of critical information needs and a proposed plan of action to guide NOAA's three-year research program that will address both science and management needs related to deep-sea coral and sponge resources in the US Northwest Atlantic.

Objectives:

- Review and understand existing exploration and research objectives for deep-sea coral and sponge ecosystems in the US Northwest Atlantic.
- Identify critical regional exploration and research information needs.
- Develop descriptions of priority activities that will address those needs.

DAY 1

8:00 Registration with Coffee and Continental Breakfast at Laboratory Conference Room

8:30 Welcome, Meeting Logistics and Review Agenda (Rich Langton)

8:45 Overview of NOAA's Deep-Sea Coral Program (Fan Tsao)

9:00 A National Marine Sanctuary Perspective on Deep-Sea Corals (Paul Ticco)

9:15 Overview of the Status of Deep-Sea Coral Research in the US Northwest Atlantic
(Martha Nizinski)

9:30 Overview of Fishery Management Council Views on Deep-Sea Coral and Sponge
Conservation and Management (Michelle Bachman and Tom Hoff)

9:50 Deep-Sea Coral Exploration and Research in Canada (Anna Metaxas)

10:15 Coffee Break

10:40 Department of Fisheries and Oceans Deep-Sea Coral Research
(Ellen Kenchington via video link)

11:00 Wrap up for the morning sessions and General Discussion (Plenary)
- Breakout group assignments and logistics

11:30 Lunch

With almost live breaking deep-sea coral news from the R/V Bigelow
and Vince Guida on a research cruise in Hudson Canyon

12:30 Break out Group Sessions

- Each group is to address Critical Information Needs in the following areas:
 - 1) Locating and Characterizing Deep-sea Coral and Sponge Ecosystems
 - 2) Biology, Biodiversity and Ecology of Deep-Sea Corals and Sponges
 - 3) Natural and Human Impacts on Deep-Sea Coral and Sponge Ecosystems

- 2:00 Breakout Group Summary Presentations to Entire Group (Plenary)
- Each group will summarize their discussions and present a list of critical research questions/needs based on those discussions
- 3:00 Coffee Break
- 3:20 Prepare a listing of the combined groups research Questions/Needs (Plenary)
- 4:00 Individual Ranking of each Critical Research Question/Need (dot exercise)
- 4:30 Finalize Prioritized Critical Questions/Needs List
- 4:50 Review of Day 1 accomplishments and discuss next steps
- 5:00 Adjourn - Dinner and Refreshments in Atlantic Highlands “on your own”

DAY 2

- 8:00 Coffee and Continental Breakfast at Lab
- 8:30 Summarize Day 1 and review agenda for Day 2
- The objective for day two is to convert research needs/questions into more specific activities that will address NOAA’s deep-sea coral and sponge mandate
- 8:45 Develop Science Activities (Breakout Groups)
- Identify a short list of activities based on applied criteria i.e.
 - Addresses a critical information need
 - Addresses a critical gap in our knowledge of deep-sea corals and sponges
 - Addresses a management need
 - Financially feasible
 - Potential of leveraging and collaboration
- 10:40 Coffee Break
- 11:00 Breakout Group Summary Presentations (Plenary)
- 11:30 Generate Summary Group List of Activities (Plenary)
- 12:00 Lunch
- 1:00 Identify Opportunities and Restraints for Activities (Plenary)
- Review and assess activities
 - Identify additional activities based on information gaps, or what else should NOAA do?
- 2:00 Review Workshop Accomplishment and Discuss Final Recommendations and Report
- 2:30 Adjourn
- A laboratory tour is available immediately after our meeting for anyone that is interested.